Exhibit B

Confirmation Note

To: Mr. Takahiro Saito

November 6, 1997
Ehara Patent Office
Person in charge: Tetsuo Wada

We enclose herewith our draft regarding a patent application requested. In line with this, please confirm the following item and return the document to us. (Please correct or note any defective portions.)

Note

1. Title of Invention	INFORMATION CODE AND ITS READING DEVICE		
2. Kind of Application	Patent Application		
3. Number of Claims	4		
4. Applicant(s)	Please refer to attached petition.		
5. Inventor(s)	Same as above		
6. Transmitted Documents	Petition	2	sheets
	Specification	10	sheets
	Abstract	1	sheet
	Figures	3	sheets
Total number of sheets (including this sheet)			sheets

7. Necessity of Request for Examination ☐ at the time of filing ☐ reserve

8. Presence of Correction

☐ There is no correction. ☐ There is a correction.

(Please indicate specifically.)

9. Other (advice · request · etc.)

A Copy of Documents Submitted to Patent Office

Patent			
Name of Applicant(s)	Takahiro Saito		
Name of Invention	Information Code and Its Reading Device		
Name of Inventor(s)	Takahiro Saito		
Number of Claim(s)	4		
Date of Application	Year	Month	Day
Filing a Request for Examination	Year	Month	Day
Application Number	Year	No.	328040
Date of Publication	Year	Month	Day
Publication Number	Year	No.	
Date of Kokoku Publication	Year	Month	Day
Kokoku Publication Number	Year	No.	
Date of Registration	Year	Month	Day
Patent Number	No.		

A seal used for authorization

〒550 Osaka-shi, Nishi-ku, Edohori 1-15-26

Osaka Commerce and Industry Building, 8th Floor

Ehara Patent Office

Phone Osaka 06 (443) 9541-3

FAX Osaka 06 (443) 9544

【Kind of document】 SPECIFICATION

【Title of the Invention】
INFORMATION CODE AND ITS READING DEVICE

【Claims for the Invention】

【Claim 1】 An information code formed by arranging three or more types of display areas in a predetermined arrangement, said display areas being different in reflected or radiated wavelength characteristic, wherein said wavelength characteristics of said display areas in said predetermined arrangement are combined to form a unit for displaying information.

【Claim 2】 An information code having a display pattern formed by arranging three or more types of display areas in the same arrangement as in one of existing information codes which are monochromatically displayed, said display areas being different in reflected or radiated wavelength characteristic, wherein said wavelength characteristics of said display areas in said arrangement are combined to form a unit for displaying information, and

wherein said information code has a framework defining a relationship between a combination of said wavelength characteristics of said display areas in said arrangement and information items represented thereby, said framework being designed to include a framework for monochromatically displaying information, defined by said one of said existing information codes.

【Claim 3】 A reader for an information code comprising:

a filter for separating reflected light or radiated light from said information code according to a difference in wavelength in use, said information code being formed by arranging three or more types of display areas in a predetermined arrangement, said display areas being different in reflected or radiated wavelength characteristic;

a plurality of detectors for photo-electrically converting light in every wavelength band separated by said filter;

a plurality of determination circuits for determining whether an output from each of said detectors exceeds a predetermined determination level; and

a decoder for decoding information displayed by said information code, based on a combination of said outputs from said determination circuits, and outputting said information decoded.

【Claim 4】 A reader for an information code comprising:

a plurality of monochromatic light sources provided so as to correspond to said information code being formed by arranging three or more types of display areas in a predetermined arrangement, said display areas being different in reflected or radiated wavelength characteristic, and so as to correspond to said different wavelength characteristics of said display areas;

a driving circuit for light-emitting each said monochromatic light source by timesharing;

a detector for photo-electrically converting said reflected light or said radiated light from said information code;

a determination circuit for fetching an output from said detector at every wavelength component in synchronization with a driving signal from said driving circuit, determining whether said output at said every wavelength component exceeds a predetermined determination level, and further determining which wavelength component is included in said output, based on said determination; and

a decoder for decoding information displayed by said information code, based on a combination of outputs from said determination circuit, indicative of respective colors, to thereby output a decoding result.

[Detailed Description of the Invention]

[Technical Field of the Invention]

The present invention relates to an information code which displays information by combining a plurality of wavelength characteristics such as colors, and a reader for reading the same.

[Prior Arts]

Information codes such as barcodes which are simple in printing and easy in reading are in widespread use as an information display means for commodities and the like.

The barcodes are classified into various types, such as the JAN code, the standard ITF, the CODE=138, the CODE=39, and the NW-7 code, which are displayed in respective specific forms. According to the display form of the JAN code which is in wide use, seven black and white bars are combined to form one module representative of one numeral, and the 13 modules thus formed are arranged to represent 13-digit numerals. In the 13-digit numerals, the first two-digit numerals represent a national number, the next five-digit numerals a manufacturer number, and the following five-digit numerals a commodity number, respectively, and the final-digit numeral is for use in checking.

[Problems which the Invention Solves]

In the JAN code, only the 13-digit numerals can be represented, and hence only the five-digit numerals are allotted to display commodities. Therefore, in recent days where commodities have been classified into more various types and packaged in smaller quantities, registering new commodities requires deletion of old commodity registrations which are unnecessary any more because 5-digit number which is registered for commodities causes lack of registerable number. .

Lack of displayable information quantity becomes significant as the field in which the barcode is employed spreads. For instance, in a phone call statement of a telephone company, the lack of the displayable information quantity is tried to be augmented by printing both a long barcode, which is increased in number of bars and a standard type barcode arranged in parallel. This method of arranging a plurality of barcodes can't be a radical solution to the problem since the barcodes can strongly oppress a display surface in which letters are described, to thereby mar the appearance; a prolonged barcode is prone to be omitted when read by a hand scanner; and this method is available only if a large display space is secured.

Further, a new usage of the barcode, such as in sales management and commodity management, has been considered by displaying, in one lump, a date of manufacture, a name of a manufacturer, a date of packing, and a shelf life. In this usage, when a purchaser of the commodity makes payment, these information items are read and recorded. However, insofar as a monochromatic barcode is employed to display such a large quantity of information items, the display pattern can be unfavorably complicated and a barcode label can be upsized, whereby the resulting barcode is rendered impractical.

Still further, another usage of the barcode, such as in manufacturing management site of industrial products, has been considered by not only applying simple information tags on component parts or products to be managed but also applying an information code which displays detailed information items, such as a production history and an inspection result, by means of information codes. This is for acquiring detailed information of the component parts or the products, on the manufacturing site or on the shipping site without inquiring to a control system using a host computer, etc.

However, in this usage as well, it has been difficult to create a practical system

because of limit of the displayable information quantity assigned to the monochromatic information code.

It is therefore an object of the present invention to provide an information code with which a quantity of information is increased without changing conventional display patterns so that the problems mentioned above can be solved.

【Means by which the Problem is Solved】

(1) The information code according to the present invention is formed by arranging three or more types of display areas in a predetermined arrangement, the display areas being different in reflected or radiated wavelength characteristic, wherein the wavelength characteristics of the display areas in the predetermined arrangement are combined to form a unit for displaying information.

Herein, the terms "being different in reflected or radiated wavelength characteristic" means that the display areas in the predetermined arrangement to form the information code are different in color, and that when the information code is formed into a stealth code using fluorescent materials, the fluorescent materials printed in the display areas are different in emitted wavelength. Further, the terms "three or more types of display areas (are) different in reflected or emitted wavelength characteristic" means that three or more types of display areas with respectively different wavelength characteristics are provided. If the display areas which are different in size and shape are used, the number of types of the display areas is equal to the number of combination between the sizes and the shapes.

A quantity of information, which can be displayed by this information code is equal to the value which is calculated by powering a number of kind of display area with a number of lined display area. Therefore, huge amount of information can be displayed compared to the monochromatic information code.

(2) When the information code according to the present invention is intended to be used by replacing an existing monochromatic information code, it is difficult to smoothly switch to the information code of the present invention if the number of companies adopting the existing information code is extremely large.

To deal with this smooth switching, the present invention provides the following information code which can coexist with the existing information code.

That is, the present invention provides the information code having a display pattern formed by arranging three or more types of display areas in the same arrangement as in one of existing information codes which are monochromatically displayed, the display areas being different in reflected or radiated wavelength characteristics,

wherein the wavelength characteristics of the display areas in the arrangement are combined to form a unit for displaying information, characterized in that the information code has a framework defining a relation.

In this information code, since an amount of information which is designated to a framework of a monochromatic information display is small compared to the overall displayable amount, the existing information code can be smoothly switched to the information code of the present invention without losing characteristic of the present invention that amount of displayed information can be increased.

(3) Unlike the monochromatic information code, the above described information code of the present invention is formed by the three or more types of display areas which are respectively different in reflected or radiated wavelength characteristic, and therefore it is necessary to discriminate the difference when reading.

A reader for the information code includes two types thereof, i.e. (a) a reader using white light as a light source, and (b) a reader using monochromatic light such as a laser source.

(a) The reader using the white light as the light source, for reading the information

code is comprised of a filter for separating reflected light or radiated light from the information code according to a difference in wavelength band which is in use, the information code being formed by arranging three or more types of display areas in a predetermined arrangement, the display areas being different in reflected or emitted wavelength characteristic,

a plurality of detectors for photo-electrically converting light in every wavelength band separated by the filter,

a plurality of determination circuits for determining whether an output from each of the detectors exceeds a predetermined determination level, and

a decoder for decoding information displayed by the information code, based on a combination of the outputs from the determination circuits, and outputting the information decoded.

(b) The reader using the monochromatic light sources such as the laser light, for reading the information code is comprised of a plurality of monochromatic light sources provided so as to correspond to the information code being formed by arranging three or more types of display areas in a predetermined arrangement, the display areas being different in reflected or radiated wavelength characteristic, and so as to correspond to the different wavelength characteristics of the display areas,

a driving circuit for light-emitting the monochromatic light source by timesharing,

a detector for photo-electrically converting the reflected light or the radiated light from the information code,

a determination circuit for fetching an output from the detector at every wavelength component in synchronization with a driving signal from the driving circuit, determining whether the output at the every wavelength component exceeds a predetermined determination level, and further determining which wavelength component is included in the output, based on the determination, and

a decoder for decoding information displayed by the information code, based on a combination of outputs from the determination circuit, indicative of respective colors of emitted light, to thereby output a decoding result.

【Mode for Carrying Out the Invention】

Referring first to Fig. 1, there is illustrated an information code 1 according to an embodiment of the invention, which is displayed in the same pattern as in the JAN code. In this information code, colors used for coating each bar are red, green, and blue which are the three primary colors of light in addition to black and white. Therefore, a single bar can represent five types of information items. (In regard of this point, a bar with wider width as viewed in the figure is formed by a plurality of consecutive bars with the same color.) The information code represents information by combining these colors, and therefore it can propose $5^{(7x13)}$ =4.03897 x 10^{63} items of information, and therefore the information quantity proposed by the information code of the invention is 1.63133 x 10^{36} times the information quantity of the conventional monochromatic JAN code which proposes $5^{(7x13)}$ =2.47588 x 10^{27} items of information..

Accordingly, the displayable information quantity extremely increases in comparison with the conventional barcode, leading to an increased number of displayable items by the information code, whereby more display digits can be allotted to each item.

This advantage will be described by taking for example an information code attached to commodities in a supermarket, in a more specific manner. By employing the information code of the invention, items such as a manufacture date, a packing date, a name of a manufacturer can be newly added to the information, to thereby improve control efficiency. In addition, the number of registered commodities can be increased, whereby chores of deleting registration of commodities which the supermarket has not dealt in can be dispensed with even when new commodities are registered.

Next, the arrangement of a reader for the information code according to the invention will be described hereinbelow. Fig. 2 shows an example of the reader using a white light source, in which reference numerals 2, 3, and 4 designate a white light source, a projecting optical system for gathering light emitted from the white light source on the information code 1, and a receiving optical system for forming image of light radiated or reflected from the information code 1. Further, reference numeral 5 designates a set of filters for separating light radiated or reflected from the information code 1 at every wavelength component, which consist, in the illustrated example, for instance, of a dichroic mirror 5R for reflecting red light and allowing light other than the red light to pass through, a dichroic mirror 5 G for reflecting green light and allowing light other than the green light to pass through, and an ordinary reflector 5B for reflecting remaining blue light. Reference numerals 6R, 6G, and 6B designate detectors for red, green, and blue colors, respectively, each formed, e.g. by a photo diode or the like when reading is carried out by scanning the barcode or alternatively formed by a CCD sensor or the like when the reading is carried out by touching the barcode. Reference numerals 7R, 7G, 7B designate amplifiers provided so as to correspond to the detectors for the respective colors, and reference numerals 8R, 8G, 8B designate determination circuits for the respective colors which each compares an output from each amplifier 7R, 7G, 7B with a predetermined reference level, to thereby determine which of the color detection signals (red, green, and blue) is included in the output. Reference numeral 9 designates a decoder for determining the color of each bar by using a predetermined timing signal, and for decoding the displayed information according to the predetermined relationship between the arrangement of the bar colors and the information items, followed by outputting the thus decoded information.

In regard of this point, the timing signal is generated based on a time period required for measuring the width of the bar as a reference value, which is measured, e.g. by a clock signal.

In addition, although the outputs from the determination circuits 8R, 8G, 8B include only three types of signals, i.e. R, G, and B detection signals, the bar colors include black and white in addition to these colors. Therefore, as shown in Fig. 3, the decoder 9 determines that the output signal represents white when all the three detection signals are present, whereas it determines that the output signal represents black when all the three types of signals are absent. When the red, green, or blue color is determined, the R, G, or B detection signal is used on condition that white color is not determined.

Then, a predetermined operating process is executed based on the information displayed by the information code decoded and output by the decoder 9, and the decoded information is output onto a display or paper, followed by recording, etc. of the information into an administrative computer.

Fig.4 shows a reader according to another embodiment of the invention, in which the information code is read by using a plurality of monochromatic light sources, such as laser sources including laser scanners and hologram scanners. In this embodiment, the laser sources are used corresponding to colors used in the information code, such that the laser sources emit light by timesharing.

In Fig. 4 reference, reference numerals 11R, 11G, 11B designate monochromatic light sources, such as laser sources emitting light with red, green, and blue colors, respectively, and reference numeral 12 a driving circuit for light-emitting each laser source by timesharing. Reference numerals 13R, 13G, 13B designate projecting optical systems for introducing light emitted from the laser sources to the information code 1, reference numeral 14 a receiving optical system for receiving light reflected by the information code 1, reference numeral 15 a detector formed by a photo diode or the like, for photo-electrically converting the light transmitted through the receiving optical system 14, and reference numeral 16 an amplifier for amplifying a photo-electrically converted output, respectively. Reference numeral 17 designates a determination

circuit for fetching an output from the amplifier 16 at every wavelength component in synchronization with a driving signal from the driving circuit 12, determining whether or not the output at every wavelength component exceeds a predetermined determination level, and further determining which wavelength band component is included in the output. Reference numeral 18 designates a decoder which outputs a digital signal by decoding information displayed by the information code, based on a combination of results of the determination by the determination circuit. The recognition of each bar by using the decoder with reference to the timing signal, determination of white and black, and outputting process of the decoder is carried out in the same matter as in the embodiment shown in Fig. 2.

The monochromatic light source for use in the above described timesharing method is not limited to the laser source. For example, it is possible to use light-emitting diodes of three colors (R, G, and B) in place of the laser sources. The timesharing method is advantageous in that a light receiver, such as a photo diode or a CCD sensor, and a processing circuit for processing an output therefrom can be shared, and accordingly the plurality of filters and light receivers are not required unlike a case where white light source is used, which leads to simplified construction of the light receiving side of the reader.

Next, description will be made of a case where the information code according to the invention is employed in the sales site where the monochromatic information code is actually used.

When the information code of the invention is employed in order to cope with the lack of information quantity displayed by the conventional information code, it is impossible to cope with the information code displayed by the plurality of colors of the invention in a display manner. For example, the number of bars for use in representing a single-digit numeral is different. Therefore, it is necessary to discriminate the difference when reading.

In this case, to read both the conventionally used monochromatic information code an newly employed information code applied on the commodities, etc., reading means can be doubly provided. In this case, however, the reader becomes complicated, resulting in hiked costs.

To eliminate the inconvenience, the information code according to the invention is designed to be the same in display pattern as the other monochromatic barcode, and at the same time a framework defining the relationships between the combination of the display areas of the information code of the information and the represented information items is designed to include a framework for monochromatically displaying information, according to the other information code. By this designing, switching from the monochromatic barcode to the color barcode can be facilitated without hiked costs of the reader.

More specifically, as shown in Fig. 1, for instance, the information code of the invention is formed by bars of five colors, i.e. white, black, red, green, and blue in the same pattern as in the JAN code, and out of the information code in the display pattern formed by the combination of the colored bars, black and white bars alone are used as the barcode of the JAN code as they are. The conventional monochromatic JAN code is different from the information code displayed by the plurality of colors of the invention in a display manner. For example, the number of bars for use in representing a single-digit numeral is different. Therefore, it is necessary to discriminate the difference when reading.

A process for reading either the conventional monochromatic barcode or the color barcode of the invention is described in Fig. 5 for instance. This process will be described as part of the process executed by the determination circuit 17 and the decoder 18 of the reader shown in Fig. 4. First, a light receiving signal output from the amplifier 16 is processed based on a timesharing signal from the driving circuit 12 and the predetermined timing signal, to thereby determine whether or not each bar includes

any of the three colors of R, G, and B. Next, it is determined whether the color of each bar is white, black, red, green, or blue, based on the principle described hereinbefore with reference to Fig. 3. Then, it is determined whether or not all the bars or the bars in a specific range assume white or black, and based on a result of the determination, it is further determined whether or not the conventional JAN code is used. If the bars are displayed by the conventional JAN code, a JAN code interpretation table is referred to, whereas if they are displayed by the information code of the invention, an information code interpretation table of the invention is referred to. Then, data represented by the bar code are decoded, followed by outputting digital data. In regard of this point, the determination as to whether the conventional JAN code is employed may be carried out to the entire information code or alternatively to each information unit, such as a commodity code out of the entire information code.

The above description has been made of the information code having the same display pattern as in the JAN code, but this is not limitative. Alternatively, the information code of the present invention can be applicable to barcodes having the other display forms, such as the standard ITF, the CODE=138, the CODE=39, and the NW-7 code, as well. For example, the standard ITF and the CODE=138 are the forms in which the number of the barcodes are reduced by combining bars with different widths. Therefore, when colors of the information code of the invention are combined with these bars, the number of information items represented by a single bar is as many as (the number of width types) $\times$ (the number of colors), and therefore the effect of the present invention can be further enhanced.

Further, the present invention is also applicable to a two-dimensional code and a stealth code.

The two-dimensional code is for displaying information by combining two-dimensionally arranged display areas (minimum display units coated with black or white), which includes the well-known PDF417, Carra code, etc. According to the invention, this two-dimensional code is formed by the three or more display areas which are different in reflected or radiated wavelength characteristic, and the wavelength characteristics of the respective display areas in the two-dimensional arrangement are combined to represent a unit for displaying information.

In this case, the increased quantity of the displayable information brought about by multi-coloring according to the invention is displayed in the two dimensional code having a large number of arrangements of the display areas. As a result, the quantity of displayable information can be especially increased.

In the stealth code, the information code is printed by using pale transparent ink containing a fluorescent material, and when the information code is irradiated by excitation beams such as infrared rays, light radiated from the fluorescent material is detected, to thereby carry out reading. The stealth code is rendered invisible with naked eyes, and therefore it is excellent in security and designing.

In implementation of the information code of the invention in the stealth code, a plurality of types of fluorescent materials which radiates light with different wavelengths are provided, and the display areas are coated with inks containing the fluorescent materials, followed by printing the information code. For example, red, green, and blue are displayed by coating the areas with the inks containing the fluorescent materials radiating light of the respective colors, white is displayed by an ink containing a mixture of the above three fluorescent materials, and black is displayed by not coating the area.

Reading is carried out in the following manner: That is, infrared rays or the like for exciting the fluorescent materials are applied to the fluorescent materials, to radiate beams of the respective colors, and the thus radiated beams with different wavelengths are read by the reader formed by combining the filter and the detector, as shown in Fig. 2, at every wavelength. In this reading system, the fluorescent material may be one, which radiates not visible rays but invisible rays such as infrared rays.

In the above embodiments, colors (reflected or radiated wavelength characteristics) employed in the information code of the invention are red, green, and blue, in addition to black and white, but this is not limitative. Alternatively, the colors may be cyan (C), magenta (M), and yellow (Y), or the other combination of colors. Further, the number of the colors can be increased by employing neutral colors between these employed colors, which further increases the number of displayable information items. As the number of colors is increased , the effect extremely increases. However, a too large number of the colors requires a reader with higher accuracy, which imposes high costs. The suitable number of colors with which satisfactory effect of the invention is achieved an at the same time manufacturing costs can be suppressed low is five, under current circumstances, i.e. three colors of red, green, and blue or cyan, magenta, and yellow, in addition to black and white.

【Effect of the invention】

By applying this invention, a quantity of information which can be displayed by the information code is increased exponentially because a displaying area constituting an information code is separated into more than three colors. (reflected or radiated wavelength characteristics) Therefore, it solves the problem of lack a quantity of display of conventional information codes, and an information code can be utilized in new ways by ability of the present invention to display huge amount of information.

【Brief Description of the Drawings】

【Fig.1】 A view showing an example of an information code formed in the same display pattern as in a conventional monochromatic barcode.

【Fig.2】 A block diagram showing the arrangement of an information code reader using a white light source, according to the present invention.

【Fig.3】 A timing chart which explains a manner of black and white indication signals based on three (R, G, and B) detection signals.

【Fig.4】 A block diagram showing information code reader using a monochromatic light source in a manner of emitting the light by timesharing, according to the present invention.

【Fig.5】 A flowchart showing a process for determining a color, which is executed by a decoder of the reader, based on a result of determination by a determination circuit.

【Description of Signs】

1.	information code
2.	white light source
5.	filter
6, 15	detector
8R, 8G, 8B, 17	determination circuit
9, 18	decoder
11R, 11G, 11B	monochromatic light source
12	driving circuit of monochromatic light source

【Kind of document】 ABSTRACT

【Abstract】

【Problem】

An actual condition where an amount of information displayed by monochromatic information code is limited is solved by providing an information code which copes with the lack of the number of displayable items of commodities and the number of sub-items allotted to each item, without enlarging the information code.

【Means by which the problem is solved】

The information code is formed by arranging three or more types of display areas in a predetermined arrangement, the display areas being different in color (reflected or radiated wavelength characteristic), and the wavelength characteristics of the display areas in the arrangement are combined to form a nit for displaying information.

【Selected Figure】 Figure 1